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7/12/05

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET- SUITE 300
DENVER, CO 80202-2466
Phone 800-227-8917
http://www.epa.gov/region08

Ref: 8EPR-ER

Oct 6, 2005

ACTION MEMORANDUM

SUBJECT: Request for a Non-Time-Critical Removal Action at the American Fork Canyon/Uintah National Forest - Pacific Mine Site, Utah County, Utah.

FROM: Peter Stevenson, On-Scene Coordinator
Emergency Response Team

THRU: Johanna Miller, Supervisor
Emergency Response Unit

Doug Skie, Director
Preparedness, Assessment & Emergency Response Program

TO: Max H. Dodson, Assistant Regional Manager
Office of Ecosystems Protection & Remediation

Site ID#: 08CW

Category of Removal: Non-Time-Critical, PRP-Lead

I. PURPOSE

The purpose of this ACTION MEMORANDUM is to request and document approval of the proposed Removal Action described herein for the American Fork Canyon/Uintah National Forest – on the private-property portion of the Pacific Mine site (Site) located in Utah County, Utah.

This Removal Action will address the need to mitigate the threats to the environment, tourists/recreational visitors, and animals/wildlife on a portion of the Site owned by Tout Unlimited. The threat is posed by high concentrations of metals (especially lead, zinc, arsenic, and mercury) in the waste rock, tailings pile, and mine drainage from the former Pacific Mine. The levels of contamination and the unsecured nature of the situation ~~dictate a Non-Time Critical Removal Action. Conditions existing~~ at the Site present an imminent and substantial endangerment to human health and the environment and meet the criteria for initiating a Time Critical Removal Action under 40 CFR, §300.415 (b)(2) of the National Contingency Plan (NCP).

they don't and won't own it. I think it's Snowbird.

PS 7/12/05 Cahn ENF-L 7/20/05 w/changes

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

The CERCLIS# for the entire American Fork Canyon/Uintah National Forest site is UTD988074951. The Region VIII Environmental Protection Agency (EPA) has not conducted a Removal Action at the American Fork/Uintah National Forest site; however, the United States Forest Service (USFS) completed a removal on a portion of the Site at the Dutchman Flat area and at the Pacific Mine in 2002/2003. The proposed Removal at the Pacific Mine (private land portion) would be the third Removal Action and will be conducted by Trout Unlimited.

The Site is a part of the American Fork Canyon Watershed Reclamation Project (See Exhibit 1 - attached) and is eligible for listing in the National Register of Historic Places (*Heritage Resource Inventory of American Fork Area Mine Closures, 11/8/94*). Various areas along the American Fork River are being considered for removal action, but the purpose of this Action Memorandum is to address the removal and disposal at property owned by Trout Unlimited in Pacific Mine area which is approximately 3 acres. The Site contains contamination from mine waste dumps and adits generated by historic mining activity on the claim.

Nope

1. Removal site evaluation

Through funding under the Clean Water Act, the USDA Forest Service (USFS) completed water quality sampling, macroinvertebrate inventories, soils analyses, sediment sampling, and fish tissue sampling in the American Fork Mining District in 1988, and studies were conducted as follows: 1) 1992 under a contract to Lidstone and Anderson; 2) 1998 & 1999 sampling by USFS; 3) 1999 by USGS Tracer study in the North Fork of American Fork River; and 4) 2000 by USGS Tracer Study in Mary Ellen Gulch.

In 2000 the Bureau of Reclamation (BOR) was contracted to conduct an XRF soil sampling to delineate the extent of heavy metal contamination at the Dutchman mine, the Sultana smelter, the Pacific and Dutchman smelter, and various other mine sites in the American Fork Canyon (See Exhibit 2 - attached). A site which exhibited and released large concentrations of hazardous materials from the American Fork Mining District was the Pacific Mine area. Its tailings deposit impinges on the North Fork of the American Fork River (in places forming the banks of the stream) and contains an abundance of heavy metals, including lead at an average concentration of 17,000 parts per million (ppm), cadmium 44 ppm, copper 335 ppm, zinc 6,000 ppm, arsenic 165 ppm, barium 1850 ppm, and iron 14,000 ppm in the surface soil.

Using the Resource Conservation and Recovery Act (RCRA) TCLP METALS Method 1311 for an inorganic analysis of these field samples, the BOR report (Exhibit 2) shows that arsenic, cadmium, and lead exceed the EPA regulatory standards (RS) at several of the sampling areas at Pacific Mine (OU2) - with lead testing as high as 220 mg/L (RS = 5 mg/L), arsenic as high as 56 mg/L (RS = 5 mg/L), and cadmium as high as 1.9 mg/L (RS = 1 mg/L). The BOR sampling report indicates that it may be necessary to remove 2 to 3 feet of material below the waste tailings to reach "clean" soils.

Macroinvertebrate inventories and fish tissue samples showed that: 1) macroinvertebrate populations in the river above the Site were approximately 14,000 individuals per square meter but below the Site they were only 4,000 individuals per square inch - the diversity index of species also fell from 12 to 8; and 2) fish below the Site had an average of 10 times as much (with a high of 20 times as much) lead as the fish above the Site. The lead-level in the fish was above the amount recommended for human consumption (the

Food and Drug Administration has established safe [action or guidance] levels for lead of 1.5 and 1.7 ppm in crustaceans and shellfish, respectively.

The Pacific Mine site has been the focus of several studies conducted by graduate students from the Universities of Wyoming and Utah State. One Master of Science candidate, Phyllis Bustamante, reported:

> "The total Pb content at this site is considerably above the EPA threshold and exists in a form that is harmful to human health.....Lead at this site may pose a threat to human health if ingested by children.....If this area is to be visited by historians and recreationalists, signs should be posted informing people of the potential hazards of the tailings.....Measures should be taken to keep off-road vehicles off the tailings in order to reduce erosion potential."

In a January 18, 2000, memorandum to the Forest Supervisor from Uinta National Forest's Hydrologist, recommendation was made to close the Pacific Mine to recreational use. His concerns centered on the high levels of contaminants at the site that could become air borne dust (occurring naturally or caused from ATV riding) that could be inhaled at concentrations hazardous to human health. In July of 1985, Ben Albrechtsen, R-4 Recreation Specialist, recommended closure of the site to off-road vehicles and initiation of testing to determine the contamination level at the site.

2. Physical location

The Site is located east of Forest City within Sections 22, T3S, R3E, SLB&M, adjacent to the North Fork of the American Fork River in the American Fork Canyon, Utah County, Utah (See Location Map in Exhibit 1 - attached).

3. Site characteristics

The American Fork Canyon Watershed's topography is typically high (Site's elevation = 7,800 feet) with rugged alpine peaks and lakes in cirque basins, steep to moderately steep timbered slopes, narrow canyon bottoms, and brush/grass covered slopes and ridges. The vegetation types in the area are aspen, spruce/fir, dry and wet meadow vegetation, subalpine and alpine herblands. The annual precipitation is 50 inches, mostly in the form of snow. The area is highly mineralized and has many historic mines and mills.

The geology of the American Fork area is composed of layers of rock (cambrean through permian) with an total thickness of about 12,000 feet. A series of limestones, quartzites, shales, and dolomite units are exposed throughout the geologic time scale, intruded by igneous rocks, creating metamorphic effects. The upper American Fork area is crossed by numerous faults, including Silver Fork Fault near Mineral Flat, Pittsburg Fault near Pittsburg Mine, Fork Canyon Fault, several faults in the Miller Hill area, the Pacific Fault, and the Dutchman Fault. This area is drained almost wholly by three streams of generally westerly course: Little Cottonwood Creek, Big Cottonwood Creek, and the American Fork. The American Fork's main tributary is the stream in Mary Ellen Gulch (See locations of above areas in Exhibit 1).

The adits, historic constructed features, and the waste rock piles are predominantly on patented (private) lands while the tailings piles are principally located on ~~trespass on~~ USFS lands.

4. Release or threatened release into the environment of a hazardous substance, or pollutant or contaminant

As evidenced by the sampling analyses and Site evaluation which have been completed thus far, there are several concerns at the Site. These have already been briefly discussed in relation to the evaluation of the Site (IIA1). The release of hazardous substances, pollutants, or contaminants into the environment is largely the result of the on-site materials. These consist of ores and tailings, adits that have been closed with native soils/rock, concrete pillars or foundations, and timber cribs, all of which are easily accessible to heavy recreational use. Metals (especially arsenic, lead, zinc, and mercury) have been found in the soil and surface water sediments and there is evidence that the American Fork River and associated wetlands/creeks which flow downstream to Utah Lake are being contaminated with trace metals. Additionally the potential for airborne migration off-site is of concern.

On March 21, 2001, the Risk Assessment and Toxicology Program Manager from Tetra Tech EM, Inc. completed a Draft Memorandum (Exhibit 2 - Attached), Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at Dutchman Flats and Pacific Mine Sites, American Fork Canyon. In summary, the memorandum stated that, after reviewing the analytical data, metal-contaminated soil and mine waste (tailings) present imminent health risks to the public and the environment at the Pacific Mine Site. In particular, inhalation, dermal, and ingestion exposure of recreationists accessing the area are expected to result in unsafe exposure to lead and arsenic. Additionally, levels of lead, arsenic, and zinc from the mine runoff are adversely impacting the fish and fauna downstream from the Site. If there is delayed or no action on the privately owned lands that are the subject of this Action Memorandum, contamination will continue into surface water, the river, the drainage and previously cleaned areas on USFS land. This will increase the public health risks and threats to the environment for children or adults who visit the Site and/or use the area for recreation/fishing. If heavy metals continue to enter the river and wetlands in this fashion, the range of contamination and the potential adverse impacts to benthic and terrestrial organisms, plants, fish, and the environment will also increase.

5. NPL status

This Site is not an NPL site nor has it been proposed to be on the NPL list.

B. Other Actions to Date

1. Previous actions

After listing of the Pacific Mine on EPA's CERCLIS in 1992, the Uinta National Forest completed a Preliminary Analysis of Pacific Mine and other sites in the American Fork Mining District. Releases of hazardous substances and contamination of National Forest resources were confirmed through the analysis that was completed in June 1994.

Since 1997 the USFS has conducted numerous studies at the American Fork Canyon Watershed which have largely been funded by the Clean Water Action Plan of the

abandoned mine restoration program. The studies included water quality, soils, stream sediment, macroinvertebrate, and fish. Most of the studies were concentrated in the heavily mined district (including the Pacific Mine area), with the inclusion of baseline data for the areas above the mining regions. All tests indicated and confirmed releases from the Pacific Mine.

In October of 1999 the USFS assigned an OSC to the American Canyon Watershed Reclamation Project and on January 24, 2000, a meeting was held between the Forest Service, Utah Division of Water Quality, and the Utah Division of Oil, Gas, and Mining. It was recognized by all the participants that the data that had been collected for the Pacific Mine indicated closure of the area to recreational users should occur as quickly as procedures would allow. Subsequently, a Community Relation Plan was developed, letters were sent to elected official alerting them of the contamination in American Fork Canyon, meetings were held with the Utah Council of Governments, and the public was banned from approximately three acres of mine tunnel and tailings at the Pacific Mine.

explain that access to non-banned areas still causes endangerment

On June 21, 2000, USFS hosted a meeting and invited the EPA, the Utah Department of Environmental Quality (UDEQ), the Utah Department of Water Resources (UDWR), and U.S. Fish and Wildlife. Results of the various environmental studies and land ownership were presented to the agencies. The groups visited many of the sites in the North Fork Canyon Watershed and all agreed that several sites posed unacceptable risk to the environment and recreationists in the canyon. The group also discussed potential repositories for waste materials from the sites and appropriateness of additional studies to include surveying and drilling in order to develop a removal plan. Therefore an Interagency Agreement (IAG) was entered into with the Bureau of Reclamation (BOR) in September of 2000 to do surveying and sampling for a complete characterization of the Dutchman Site, the Pacific Site, and a Common Repository. BOR completed those field operations in October of 2000 and provided data needed to prepare contract plans and specifications for removal actions.

In 2002 and 2003, the USFS conducted a Removal Action on its portion of the Pacific Mine Site. All contaminated waste rock, tailings, and soil were removed; and the remaining topsoil was shaped into a series of wetland depressions. The private land immediately above this area is the subject of this Action Memorandum. Without removal actions at the Site defined in this document, and other similar areas, heavy metals will continue to enter the river and wetlands, and the range of contamination and the potential adverse impacts to benthic and terrestrial organisms, plants, fish, and the environment will increase. Public health risks and threats to the environment to children or adults who visit the Site and/or use the area for recreation/fishing contamination will continue at surface water, river, drainage and previously cleaned areas.

2. Current actions

There are no other actions being taken or proposed that are not discussed in this Action Memorandum.

C. Federal, State, and Local Authorities' Roles

1. State and local actions to date

As outlined above, State and local agencies have discussed the concerns about the Site and will continue to be involved in the investigation/assessment/Removal at the Site.

2. **Federal Role**

EPA will monitor the PRP Removal Action as defined in ~~the~~ a separate enforcement ~~attachment~~ addendum.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

The conditions at the Site present ~~an imminent and substantial endangerment~~ threat to public ~~human~~ health, welfare and the environment, and meet the criteria for initiating a Removal Action under 40 CFR Section 300.415 (b)(2) of the NCP. The following factors from § 300.415 (b)(2) of the NCP form the basis for EPA's determination of the threat present and the appropriate action to be taken:

(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iii) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;

(iv) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;

(v) The availability of other appropriate federal or state response mechanisms to respond to the release; and,

A. Threats to Public Health or Welfare

There is a potential for 1) direct access and trespassing on the areas of the Site where hazardous substances exist, 2) airborne migration of hazardous substances from the Site, 3) migration of contamination/hazardous substances from the Site into the regional groundwater, and 4) migration of contaminants and/or hazardous substances off-site to ponds, wetlands, previously reclaimed areas, and other surface water.

Over 1.2 million visitors pass through American Fork Canyon's fee collection station each year. The North Fork area is a notable tourist attraction with its historic mining landscape amidst the scenic beauty of the canyon. The large skiing recreational use is being continuously developed in the area, and in 1999 ski lifts were constructed in the headwaters of American Fork Canyon by Snowbird Lt., accessed from their resort in Little Cottonwood Canyon on the Wasatch-Cache National Forest.

The popularity of the North Fork of the American Canyon is in part due to the fact that it comprises a block of public and private lands totaling 14,500 acres classified as "roaded" - with roads and trails open to ATV use. It is surrounded by much larger areas of "designated wilderness" and "inventoried unroaded lands". Many people come to the North fork to recreate because it is less restricted than any other NFS land in as close a proximity to Utah's population center. This Removal Action's Site lies along the North Fork within this popular motorized recreation route which leads to the Site's tailings piles. There are individuals who frequent the tailings pile sites almost daily during the summer months.

The Site falls within the Land and Resource Management Plan of Uinta National Forest, and the Plan states that population increases nearby will place more demand on the area. It states that additional recreation use in the area will include motorized sight seeing, ATV and Jeep riding, fishing, exploring mine sites, picnicking, hiking, camping, hunting, and equestrian riding.

The January 26, 2001, Draft Memorandum (Exhibit 2 - Attached), Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at Dutchman Flats and Pacific Mine Sites, American Fork Canyon, states that "after reviewing the analytical data, metal-contaminated soil and mine waste (tailings) present imminent health risks to the public and the environment at the Dutchman Flats' Site. Health and environmental risks at the Site include impacts on human health through recreational use of the mine site areas and resulting inhalation, dermal and ingestion exposure to metals-contaminated tailings material. In addition, a potential for human exposure to high levels of metals exists through the consumption of locally caught fish. Environmental impacts include the potential effects of stream contamination on populations of Bonneville cutthroat trout, a State of Utah conservation species, and documented reductions of macroinvertebrates downstream from the Site."

But were talking about Pacific

B. Threats to the Environment

Wildlife in the adjacent habitats and the fish in the confluent waters are exposed to metals contamination either through direct contact with the effluents/ standing water/ sediments or indirectly through consumption of organisms (algae, aquatic insects, or animals) feeding in the area. As detailed in the "evaluation section" (IIA1) of this Action Memorandum, these pathways have been extensively studied by USFS/USGS under a Clean Water Action Plan. Macroinvertebrate inventories and fish tissue samples showed that macroinvertebrate populations in the river above the Site were approximately 14,000 individuals per square meter but below the Site they were only 4,000 individuals per square inch, and fish below the Site had an average of 10 times as much (with a high of 20 times as much) lead as the fish above the Site. The lead-level in the fish was above the amount recommended for human consumption. The river is a spawning and rearing stream for Bonneville cutthroat trout (a sensitive species), brown, and rainbow trout. Utah State classifies American Fork River as a Class 3-A Cold Water Fishery.

The area provides habitat for elk, mule deer, bighorn sheep, Rocky Mountain goat, black bear, bear, moose, mountain lion, marmot, and abundant beaver. The habitat is also suitable for the spotted frog. — Describe threat.

A threat to the environment also exists through the migration of and airborne exposure to the contaminated particles and dust. On dry windy days, the dust and particles may migrate to the surface waters, wetlands, and other recreational areas as they become airborne.

Arsenic

Arsenic may bioaccumulate in aquatic organisms. Arsenic bioaccumulates primarily in algae and lower invertebrates. The embryonic and larval stages of aquatic animals are generally the most sensitive and sediment-feeding organisms will contain higher metal concentration than other organisms.

Lead

Lead is ubiquitous in the environment and although bioaccumulation is known to occur, and lead is found in the tissue of many wild animals, including birds, mammals, fishes, and invertebrates, the most publicized effects of lead have been on the impact of ingestion of lead by waterfowl. Acute and chronic lead toxicity have been demonstrated as a definite threat to bird populations. There is also evidence that lead at high concentrations can eliminate populations of bacteria and fungi on leaf surfaces and in soil. Many of the microorganisms play key roles in the decomposer food chain.

Zinc

Zinc produces acute toxicity in freshwater organisms over a range of concentrations from 90 to 58,100 ug/liter, and appears to be less toxic in harder water. Acute toxicity is similar for freshwater fish and invertebrates. A final acute-chronic ratio for freshwater species of 3.0 has been reported. Some researchers have speculated that exposure to excessive amounts of zinc may constitute a hazard to animals. Laboratory studies and findings in animals living near lead-zinc smelters suggest that excessive exposure to zinc may produce bone changes, joint afflictions, and lameness.

Also see analysis and further data in the January 26, 2001, Draft Memorandum (Exhibit 2 - Attached), Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at Dutchman Flats and Pacific Mine Sites, American Fork Canyon.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances, pollutants and contaminants from this Site, if not addressed by implementing the response action described in this ACTION MEMORANDUM, present potential imminent and substantial endangerment to public health, or welfare and the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed action description

Removal Actions will be implemented at the Site to remove and dispose of contaminated soils, while maintaining the integrity of the historic Pacific Mine concrete foundations, with said soils to be shaped or transported to and disposed of in an area on-site.

Specifically, waste rock, contaminated soil, and tailings with arsenic concentrations greater than 400 mg/Kg and/or lead concentrations of 2000 mg/Kg will be excavated or shaped on-site.

Trout Unlimited is producing a design and work plan for the consolidation and capping of the tailings/waste rock on private property. The tailings will be covered with topsoil and rocks as necessary, to discourage trespass by ATV and other off-road vehicles. The repository will be shaped to encourage the run-off from the repository into drainage channels which surround the repository; hence, "run-on" will be eliminated and "run-off" will be directed off the pile. When completed, the stockpile will be seeded with a seed-mix approved by USFS.

2. Contribution to remedial performance

The Removal Action described herein will remediate the site; and, therefore, no Remedial Action, including preparation of an HRS Scoring Package will be necessary.

3. Description of alternative technologies

N/A

4. EE/CA

An EECA is attached (Exhibit #3).

5. Applicable or relevant and appropriate requirements (ARARs)

This Removal Action will attain to the extent practicable, considering the exigencies of the situation, applicable or relevant and appropriate requirements of federal environmental or more stringent state environmental laws. ~~In general, the ARARs will consist of USDWR adopted stream water quality standards and a list of ARAR's provided to the USFS/EPA by UDEQ, State of Utah - a summary of which is provided below:~~

Where are these listed?

FEDERAL

a. National Historic Preservation Act (16 USC Section 470; 40 CFR Section 6.301 (b); and 36 CFR Part 800).
b. Endangered Species Act of 1973 (16 USC Section 1531; 40 CFR Subpart C, Section 6.302 (h); and 50 CFR Part 402).
c. Clean Water Act (33 USC Sections 1341 and 1344).
d. Clean Water Act (40 CFR Part 230).
e. Executive Order 11988 (Floodplain Management, 1977),(40 CFR Subpart C, Sec. 6.302 (b)).
f. Executive Order 11990 (Wetlands Protection), (40 CFR Subpart C, Sec 6.302 [a]).
g. Fish and Wildlife Coordination Act (16 USC Section662); (40 CFR Subpart C, 6.302 [e]).
h. Occupational Safety and Health Act of 1970 (29 USC Section 651) The Health & Safety Standards for Employees Engaged in Hazardous Waste Operations, (50 FR 45654).
i. Resource Conservation and Recovery Act (RCRA), Subtitle C (capping and placement requirements are relevant and appropriate), and Subtitle D (solid waste disposal requirements are applicable).
k DOT Hazardous Material Transportation Regulations (49 CFR Parts 107, 171-177).
l. Toxic Substances Control Act ((40 CFR Parts 129, 750, and 761).

STATE

a. Utah Safe Drinking Water Act (19-4-101 ET SEC UCA; R449, UAC).
b. Utah Groundwater Protection Rules (R448-6 UAC).
c. Utah Water Pollution Control Act (19-5-101 ET SEC UCA; R448-2 UAC, R448-8 UAC).
d. Utah Air Conservation Act (19-2-101 ET SEC UCA; R446-1 UAC).
e. Utah Occupational Safety and Health Act (35-9-1 UCA; R500 UAC, Subpart 126, Subpart 216, Subpart 102).
f. Utah Wildlife Protection Act (23-15-6 UCA).
g. Utah Channel Diversions (23-15-5 UCA).
h. Utah Water Regulations (73-3-29 UCA).
i. Utah Well Drilling Standards (R655-1 UAC)
j. Utah Solid & Hazardous Waste Act (R315-1,2,&5 UAC)

6. Project Schedule

If AOC requirements and a Work Plan can be timely met, it is anticipated that the proposed Removal Action will commence in late 2004.

B. Estimated Costs

All costs will be covered by Trout Unlimited. The total estimated cost is $150,000.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Contamination will continue at surface water, river, drainage and previously cleaned areas on USFS land. Delayed or no action will increase public health risks and threats to the environment because the hazardous substances on-site pose a health risk to children or adults who visit the Site and/or use the area for recreation/fishing. If heavy metals continue to enter the river and wetlands in this fashion, the range of contamination and the potential adverse impacts to benthic and terrestrial organisms, plants, fish, and the environment will increase.

VII. ENFORCEMENT

A separate addendum will provide a confidential summary of current and potential future enforcement actions.

IX. RECOMMENDATION

This decision document represents the selected Removal Action for the, Pacific Mine area in the American Fork Canyon, Utah County, Utah, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. This decision is based on the administrative record for the Site.

Conditions at the Site meet the NCP §300.415(b)(2) criteria for a Removal and I recommend your approval to document the Emergency Removal Action Emergency Removal Action. The total project budget is estimated to be $150,000; however, no monies will come from the Regional removal allowance because Trout unlimited will be responsible for the removal costs.

Approve: _____ Date: _____

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Disapprove: _____ Date: _____

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection
and Remediation

Attachments:

Exhibit 1	- Location Map
Exhibit 2	- "Endangerment to Human Health and Environment Report" from Tetra Tech EM, Inc. – 01/26/01
Exhibit 3	- "Environment Evaluation & Cost Analysis", Trout Unlimited, December - 2004

SUPPLEMENTAL DOCUMENTS

Support/reference documents which may be helpful to the reader and/or have been cited in the report may be found in the Administrative Record File at the Superfund Records Center for Region VIII EPA, 999 18th Street, Denver, Colorado 80202.

Exhibit 1

AMERICAN FORK CANYON WATERSHED RECLAMATION PROJECT

PROJECT LOCATION MAP

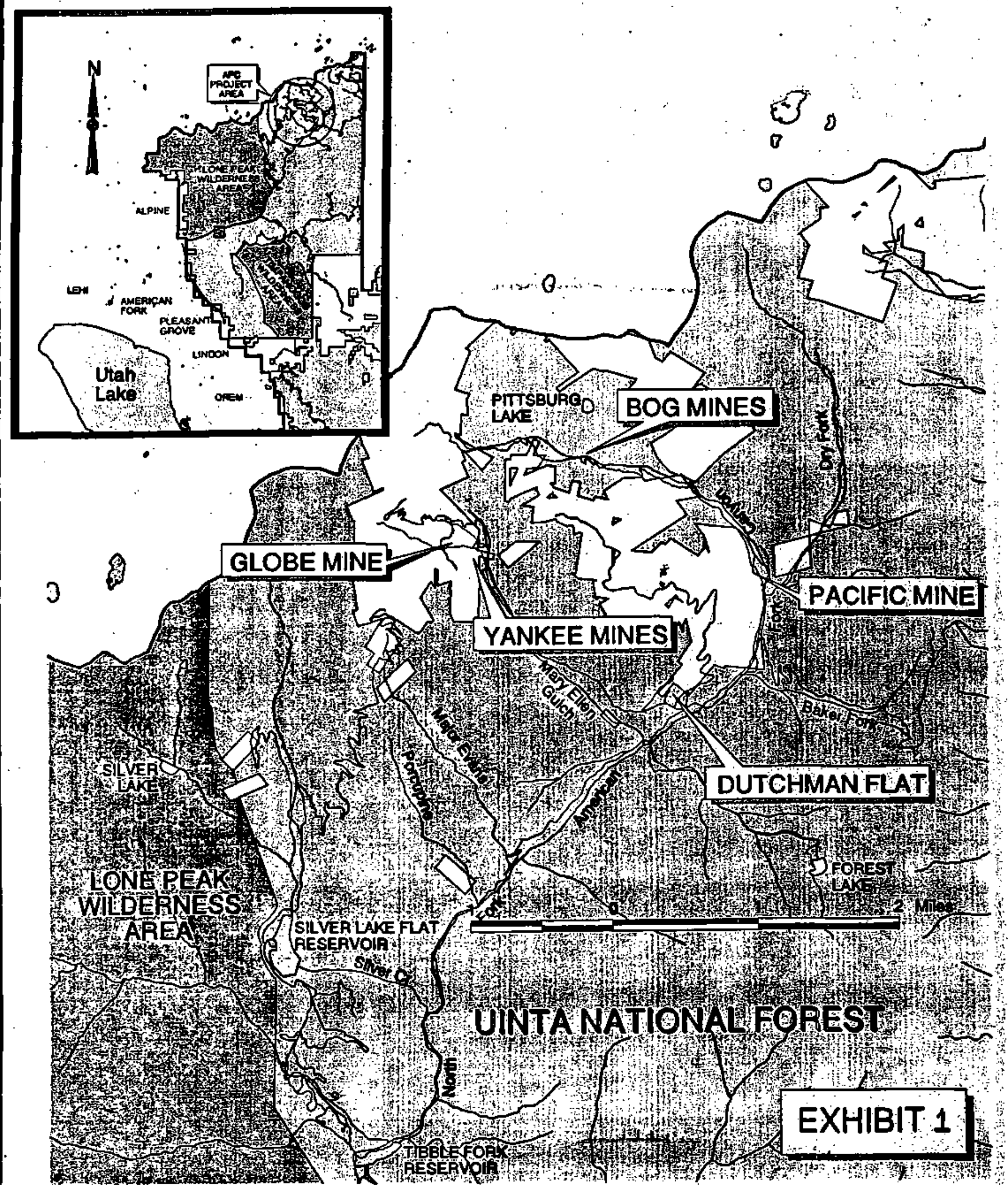

EXHIBIT 1

Exhibit 2

Tetra Tech EM Inc.

1099 18th Street, Suite 1960 ♦ Denver, CO 80202 ♦ (303) 295-1101 ♦ FAX (303) 295-2818

March 21, 2001

Mr. Pete Stevenson
On-Scene Coordinator
U.S. Environmental Protection Agency, Region VIII
999 18th Street, Suite 600, Mail Code: 8EPR-ER
Denver, Colorado 80202-2405

Subject: START2, EPA Region VIII, Contract No. 68-W-00-118, TDD No. 0101-0008. Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at American Fork Canyon Sites, Uinta National Forest, Utah County, Utah

Dear Mr. Stevenson:

This endangerment assessment describes human health and environmental risks associated with metals contamination at two mine sites in American Fork Canyon, Uinta National Forest in Utah County, Utah. Health and environmental risks at the site include impacts to human health through recreational use of the mine sites and resulting inhalation, dermal and ingestion exposure to metals-contaminated tailings and soils. In addition, a potential for human exposure to metals exists through the consumption of locally caught contaminated fish. Environmental impacts include the potential effects of contaminated soil and mine runoff on terrestrial and aquatic ecological receptors.

BACKGROUND

The Dutchman Flats site is located adjacent to the North Fork of the American Fork River in Utah County, Utah, and consists of a mill site, mine waste dump, and tailings pond. The Pacific Mine site is also located adjacent to the North Fork of the American Fork River, just north of its confluence with the Dry Fork. It consists of the Pacific Mine waste pile, the Pacific Mill, and the Pacific Mill tailings pond.

Both the Dutchman Flats and Pacific Mines are historical lead mines and have extensive piles of mine and mill tailings containing high levels of lead (up to 99,999 parts per million [ppm]) and arsenic (up to 3,700 ppm). About 46,000 tons of tailings are present at the Pacific Mine site alone. In addition to high levels of lead and arsenic in tailings, elevated levels of lead, arsenic, and zinc have been found in fish collected downstream of the Pacific Mine site, indicating that runoff from the Pacific Mine site is contaminating the American Fork River.

Human exposure to these metals is currently occurring, because both the Dutchman Flats and Pacific Mine areas are used extensively for recreation, including camping, hiking, picnicking, mine exploration, hunting, fishing, and all-terrain vehicle (ATV) and four-wheel drive vehicle use. Many of these activities can be expected to generate high levels of airborne contaminated dust, resulting in a likelihood for significant inhalation exposure to the recreational user.

Conceptual Site Model

A conceptual site model (CSM) was prepared for the American Fork Canyon sites (Figure 1). The CSM graphically illustrates the relationship between contaminant sources, release mechanisms, exposure pathways, and human population receptors. Figure 1 shows that metal contaminants at the sites derive from tailings piles, waste rock piles, and mill sites. Contaminants are released from these sources into the surrounding soils by wind erosion, surface runoff and infiltration. The primary human population receptor is considered to be the recreational user who is exposed to metal contaminants primarily through inhalation of airborne dust, incidental soil ingestion, and dermal contact with soil. Because the present analysis is only a screening evaluation, and as a result of limitations in the available data, a quantitative analysis of all potential exposure pathways was not conducted.

Human Exposure to Lead in Soil and Tailings Material

Health risks posed by lead in soil are evaluated using mathematical models to predict blood lead concentrations in children or adults. For residential exposure scenarios, the child is the relevant receptor and the *Integrated Exposure Uptake Biokinetic Model for Lead in Children* (IEUBK) is used (EPA 1994). For nonresidential exposure scenarios, as would be applicable for these mine sites, the adult is the direct receptor and the interim *Adult Lead Methodology* (ALM) is used to evaluate lead risks (EPA 1996). Both models use site-specific exposure parameters to derive a residual soil level of lead considered to be protective of human health.

According to the ALM, the pregnant woman is the direct receptor. However, lead exposure to the fetus of a pregnant woman is actually the receptor upon which the predicted protective soil lead concentration, the PRG, is based. Since the fetus is considered the more sensitive to the effects of lead than are adults or older children, protection of the fetus is considered to result in protection of adults and children as well. The ALM model is used to predict a lead concentration in soil such that less than 5 percent of pregnant women exposed to that soil concentration would experience a fetal blood lead level of greater than 10 micrograms per deciliter (µg/dl).

The ALM model incorporates several exposure parameters that can be modified on a site-specific basis to develop a site-specific PRG. In particular, the ALM model was not specifically developed to address a recreational exposure scenario as would be applicable in this case. Therefore, this model must be adjusted using exposure parameters relevant to recreational use rather than the default commercial exposure scenario. The two parameters that must be modified to accommodate a recreational exposure scenario include the soil ingestion rate and the number of days per year an individual would be exposed. The default value used in the ALM model for the soil ingestion rate is 50 milligrams per day (mg/day). This value, however, is based on the limited soil exposure that would normally occur for an office or retail worker. For recreationists involved in hiking, camping, and riding vehicles over the tailings piles, however, it can be expected that the incidental soil ingestion rate would be much higher. EPA recommends use of 100 mg/day as an "appropriate default value for contact intensive scenarios" (EPA 1999). Therefore, this value was used in the ALM model for the daily rate of incidental soil ingestion. The exposure frequency, or number of days per year (days/yr) an individual would be exposed to the mine site soils, was assumed to be 45 days/yr. This value is based on the conservative assumption that a recreationist might access these areas every other day during the three primary summer months of June, July, and August.

Large single doses of lead produce fatigue, sleep disturbances, and constipation, followed by colic, anemia, and neuritis. Chronic lead poisoning produces loss of appetite, metallic taste, constipation and obstipation, anemia, pallor, malaise, weakness, insomnia, headache, nervous irritability, muscle and joint pains, fine tremors, damage to kidney tubules and in cases of high, long-term exposure, chronic nephritis. Other effects include certain muscular weaknesses ("wrist drop") and lead encephalopathy.

The most commonly used indicator of lead exposure is the whole blood lead level. Toxic effects of lead may occur at levels so low that a threshold is effectively nonexistent. In other words, there may be no completely safe exposure to lead for children. Other signs of low-dose lead toxicity include learning deficits and growth retardation in children and hypertension in middle-aged men. Exposure to low doses of lead in childhood causes long-lasting effects that are thought to be irreversible. Sensitivity to the adverse effects of lead extends from fetal development to the cessation of growth after puberty. At very high exposure levels, lead may produce severe reproductive toxicity, inducing premature deliveries and spontaneous abortions in women and sterility in men.

Human Exposure to Arsenic in Soil and Tailings

Elevated levels of arsenic were also found in tailings at both mine sites. In order to evaluate the significance of these elevated levels, a PRG was developed for a hypothetical adult recreationist receptor using the following equation:

$$PRG = \frac{TR \times BW \times AT}{EF \times ED \left[\left(\frac{IRS \times BA \times CSF_o}{10^6\ mg/kg} \right) + \left(\frac{SA \times AF \times ABS \times CSF}{10^6\ mg/kg} \right) + \left(\frac{IRA \times CSF_i}{PEF} \right) \right]}$$

where:

TR	=	target cancer risk (1E-06)
BW	=	body weight (kilograms [kg])
AT	=	averaging time (days)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BA	=	bioavailability (unitless)
IRS	=	soil ingestion rate (mg/day)
CSF_o	=	cancer slope factor for arsenic (oral exposure route) ($(mg/kg/day)^{-1}$)
CSF_i	=	cancer slope factor for arsenic (inhalation exposure route) ($(mg/kg/day)^{-1}$)
SA	=	skin surface area for an adult (square centimeters [cm^2])
AF	=	soil adherence factor (mg/cm^2)
ABS	=	dermal absorption efficiency of arsenic (unitless)
IRA	=	inhalation rate (cubic meters [m^3]/day)
PEF	=	particulate emission factor (m^3/kg)

Human exposure to arsenic occurs primarily through chronic oral ingestion of a variety of organic and inorganic forms of arsenic. Food constitutes the largest source of daily exposure to arsenic. Humans consume an average of 25 to 50 µg/day arsenic from this source. The particular form of arsenic ingested is a critical factor. Trivalent arsenic compounds are more toxic than pentavalent forms. However, the pentavalent form is most commonly found in the environment because natural oxidation processes in the environment favor it.

Water-soluble arsenic is efficiently absorbed from the gastrointestinal tract. Reaching the systemic circulation, trivalent arsenic is detoxified in the liver by conversion to methylarsenic acid and dimethylarsenic acid, which are the principal forms excreted in the urine. The body burden of arsenic can reach considerable levels since it can be sequestered in nails, hair, bones, teeth, skin, liver, kidneys, and lungs.

The adverse health effects produced by arsenic are highly dose dependent. For example, at low concentrations, arsenic may be an essential nutrient and substitute for phosphorus in key biochemical reactions. At high levels, however, arsenic has been recognized as an effective human poison. At toxic levels, it produces severe gastrointestinal irritation, including hemorrhage, and a form of peripheral arteriosclerosis known as blackfoot disease.

Exposure to low levels of arsenic can produce malaise and fatigue, gastrointestinal distress, anemia and basophilic stippling, and neuropathy. The most characteristic pathological effects of chronic arsenic poisoning, however, are skin lesions, particularly plantar and palmar hyperpigmentation and hyperkeratotic lesions. Although these lesions in themselves do not pose a significant health concern, they may ultimately develop into malignant skin cancers and metastasize to other parts of the body.

Health Risks Due to Contaminated Fish Consumption

In addition to the health risks posed by contaminated soil and tailings, fish collected at sites downstream of the Pacific Mine site in the American Fork River show elevated concentrations of lead, arsenic, and zinc. Fish were not analyzed for mercury. The Food and Drug Administration (FDA) has not established safe levels (action or guidance levels) for detected metals in fish per se, but has established them for lead and arsenic in crustaceans and shellfish. The guidance levels for arsenic are 76 in crustaceans and 86 ppm in shellfish. The corresponding guidance levels for lead are 1.5 in crustaceans and 1.7 ppm in shellfish. By comparison, maximum levels of lead and arsenic detected in locally caught fish, although significantly elevated downstream of the mine sites, are still less than 1 ppm.

ECOLOGICAL RISKS

In addition to the screening assessment of human health risks associated with lead and arsenic in tailings material at these sites, a preliminary evaluation of ecological impacts was conducted for arsenic, cadmium, copper, lead, mercury, and zinc. This screening evaluation was based on results of sampling of surface water, soil, and macroinvertebrates, and also included consideration of potential effects on soil invertebrates, soil microbes, terrestrial plants, and fish. No sediment samples were collected; therefore impacts related to potential sediment exposure could not be evaluated and may be underestimated.

candidate for endangered species listing. Note that the presence of the spotted frog at these mine sites has not been verified. No studies of possible effects on the abundance of the Bonneville cutthroat trout or other native fish species have been conducted.

That the above adverse effects on stream fauna are being caused by mine runoff contamination is supported by the fact that lead and zinc concentrations in runoff from these sites are significantly above EPA ambient water quality criteria (AWQC) for the protection of aquatic life. The EPA AWQC for arsenic, cadmium, copper, lead, mercury, and zinc are shown in Table 2. Table 2 shows the criteria maximum concentration (CMC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect" and the criterion continuous concentration (CCC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect."

Concentrations of metals were below detection limits in most reaches of the American Fork proper, and average concentrations were below the corresponding AWQC. However, metals concentrations did exceed AWQC in tributaries to the American Fork and in surface runoff. For example, zinc levels considerably in excess of 120 µg/liter(L) (total zinc) (CCC/CMC) were detected at 5 of 20 locations sampled in tributaries of the American Fork River downstream of these mine sites. Lead and cadmium also exceed their corresponding CCC at 4 of 20 and 5 of 20 locations, respectively, in American Fork tributaries. Surface runoff concentrations of metals also significantly exceed corresponding AWQC at many locations. Zinc concentrations found in Pacific Mine runoff range up to 2,520 micrograms per liter (µg/L) (total zinc) while lead and cadmium concentrations range up to 130 µg/L lead and 27.1 µg/L cadmium respectively (as total metal).

CONCLUSIONS

Metals-contaminated soil and mine waste (tailings) present imminent health risks to the public and the environment at the Dutchman Flats and Pacific Mine sites. In particular, inhalation, dermal, and ingestion exposure of recreationists accessing these areas is expected to result in unsafe exposure to lead and arsenic. PRGs were developed for arsenic and lead using standard EPA methods. Comparison of these PRGs to levels of lead and arsenic detected in site soils and tailings materials indicates that many areas of these sites must be considered unsafe for recreational use. Levels of lead, arsenic, and zinc are elevated in fish collected downstream of these sites. However, these levels are still less than available safe levels (guidance levels) established by FDA for metals in seafood. Metals-contaminated mine runoff is adversely affecting stream fauna as indicated by 1) reduced macroinvertebrate populations downstream of these sites, and 2) by significant exceedances of AWQC for zinc, lead, and cadmium in mine runoff, the American Fork River, and tributaries of the American Fork River. The lack of sediment data and data regarding concentrations of contaminants in forage is likely to result in an underestimate of wildlife exposure to site contaminants.

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Table 2

Toxicological Benchmarks for Metals at Dutchman Flats

Metal	Terrestrial Plants[1] (mg/kg soil dw)[2]	Soil Invertebrates[3] (earthworm) (mg/kg soil dw)	Soil Microbes[4] (mg/kg soil dw)	AWQC[5] (ug/L)	
				CMC[6]	CCC[7]
Arsenic	10 to 315	60	100	340	150
Cadmium	3 to 100	20	20	4.3	2.2
Copper	60 to 125	50	100	13	9
Lead	50 to 1,000	500	900	65	25
Mercury	5 to 35	0.1	30	1.4	0.77
Zinc	50 to 500	200	100	120	120

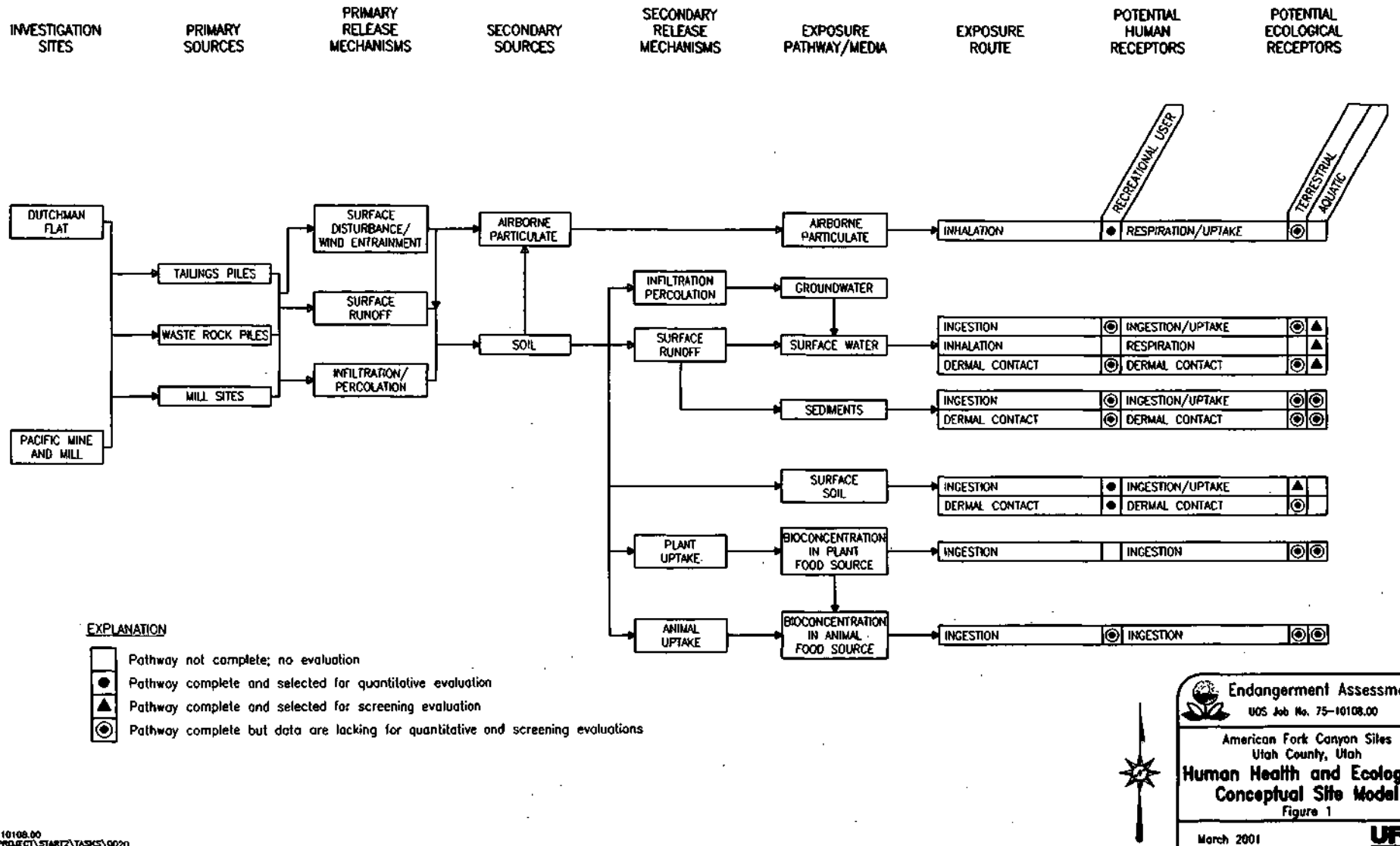
[1]From ISSI (1999).
[2]soil dw = soil dry weight basis
[3]From Efroymson et al. (1997).
[4]From Efroymson et al. (1997).
[5]AWQC = ambient water quality critiera (from Federal Register, Vol. 63, No. 237, December 10, 1998).
[6]CMC = criteria maximum concentration (an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect).
[7]CCC = criterion continuous concentration (an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect).
ug/L = micrograms per liter
mg/kg = milligrams per kilogram

ATTACHMENT A

PRG CALCULATION FOR ARSENIC

URS Operating Services
START2, EPA Region VIII
Contract No. 68-W-00-118

American Fork Canyon Sites
Revision: 0
Date: 03/2001



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Endangerment Assessment
UOS Job No. 75-10108.00

American Fork Canyon Sites
Utah County, Utah

Human Health and Ecological Conceptual Site Model

Figure 1

March 2001

URS OPERATING SERVICES

Exhibit 2

Tetra Tech EM Inc.

1099 18th Street, Suite 1960 • Denver, CO 80202 • (303) 295-1101 • FAX (303) 295-2818

March 21, 2001

Mr. Pete Stevenson
On-Scene Coordinator
U.S. Environmental Protection Agency, Region VIII
999 18th Street, Suite 600, Mail Code: 8EPR-ER
Denver, Colorado 80202-2405

Subject: START2, EPA Region VIII, Contract No. 68-W-00-118, TDD No. 0101-0008. Imminent and Substantial Endangerment to Human Health and Environment Due to Metals Contamination at American Fork Canyon Sites, Uinta National Forest, Utah County, Utah

Dear Mr. Stevenson:

This endangerment assessment describes human health and environmental risks associated with metals contamination at two mine sites in American Fork Canyon, Uinta National Forest in Utah County, Utah. Health and environmental risks at the site include impacts to human health through recreational use of the mine sites and resulting inhalation, dermal and ingestion exposure to metals-contaminated tailings and soils. In addition, a potential for human exposure to metals exists through the consumption of locally caught contaminated fish. Environmental impacts include the potential effects of contaminated soil and mine runoff on terrestrial and aquatic ecological receptors.

BACKGROUND

The Dutchman Flats site is located adjacent to the North Fork of the American Fork River in Utah County, Utah, and consists of a mill site, mine waste dump, and tailings pond. The Pacific Mine site is also located adjacent to the North Fork of the American Fork River, just north of its confluence with the Dry Fork. It consists of the Pacific Mine waste pile, the Pacific Mill, and the Pacific Mill tailings pond.

Both the Dutchman Flats and Pacific Mines are historical lead mines and have extensive piles of mine and mill tailings containing high levels of lead (up to 99,999 parts per million [ppm]) and arsenic (up to 3,700 ppm). About 46,000 tons of tailings are present at the Pacific Mine site alone. In addition to high levels of lead and arsenic in tailings, elevated levels of lead, arsenic, and zinc have been found in fish collected downstream of the Pacific Mine site, indicating that runoff from the Pacific Mine site is contaminating the American Fork River.

Human exposure to these metals is currently occurring, because both the Dutchman Flats and Pacific Mine areas are used extensively for recreation, including camping, hiking, picnicking, mine exploration, hunting, fishing, and all-terrain vehicle (ATV) and four-wheel drive vehicle use. Many of these activities can be expected to generate high levels of airborne contaminated dust, resulting in a likelihood for significant inhalation exposure to the recreational user.

Conceptual Site Model

A conceptual site model (CSM) was prepared for the American Fork Canyon sites (Figure 1). The CSM graphically illustrates the relationship between contaminant sources, release mechanisms, exposure pathways, and human population receptors. Figure 1 shows that metal contaminants at the sites derive from tailings piles, waste rock piles, and mill sites. Contaminants are released from these sources into the surrounding soils by wind erosion, surface runoff and infiltration. The primary human population receptor is considered to be the recreational user who is exposed to metal contaminants primarily through inhalation of airborne dust, incidental soil ingestion, and dermal contact with soil. Because the present analysis is only a screening evaluation, and as a result of limitations in the available data, a quantitative analysis of all potential exposure pathways was not conducted.

Human Exposure to Lead in Soil and Tailings Material

Health risks posed by lead in soil are evaluated using mathematical models to predict blood lead concentrations in children or adults. For residential exposure scenarios, the child is the relevant receptor and the *Integrated Exposure Uptake Biokinetic Model for Lead in Children* (IEUBK) is used (EPA 1994). For nonresidential exposure scenarios, as would be applicable for these mine sites, the adult is the direct receptor and the interim *Adult Lead Methodology* (ALM) is used to evaluate lead risks (EPA 1996). Both models use site-specific exposure parameters to derive a residual soil level of lead considered to be protective of human health.

According to the ALM, the pregnant woman is the direct receptor. However, lead exposure to the fetus of a pregnant woman is actually the receptor upon which the predicted protective soil lead concentration, the PRG, is based. Since the fetus is considered the more sensitive to the effects of lead than are adults or older children, protection of the fetus is considered to result in protection of adults and children as well. The ALM model is used to predict a lead concentration in soil such that less than 5 percent of pregnant women exposed to that soil concentration would experience a fetal blood lead level of greater than 10 micrograms per deciliter (µg/dl).

The ALM model incorporates several exposure parameters that can be modified on a site-specific basis to develop a site-specific PRG. In particular, the ALM model was not specifically developed to address a recreational exposure scenario as would be applicable in this case. Therefore, this model must be adjusted using exposure parameters relevant to recreational use rather than the default commercial exposure scenario. The two parameters that must be modified to accommodate a recreational exposure scenario include the soil ingestion rate and the number of days per year an individual would be exposed. The default value used in the ALM model for the soil ingestion rate is 50 milligrams per day (mg/day). This value, however, is based on the limited soil exposure that would normally occur for an office or retail worker. For recreationists involved in hiking, camping, and riding vehicles over the tailings piles, however, it can be expected that the incidental soil ingestion rate would be much higher. EPA recommends use of 100 mg/day as an "appropriate default value for contact intensive scenarios" (EPA 1999). Therefore, this value was used in the ALM model for the daily rate of incidental soil ingestion. The exposure frequency, or number of days per year (days/yr) an individual would be exposed to the mine site soils, was assumed to be 45 days/yr. This value is based on the conservative assumption that a recreationist might access these areas every other day during the three primary summer months of June, July, and August.

Large single doses of lead produce fatigue, sleep disturbances, and constipation, followed by colic, anemia, and neuritis. Chronic lead poisoning produces loss of appetite, metallic taste, constipation and obstipation, anemia, pallor, malaise, weakness, insomnia, headache, nervous irritability, muscle and joint pains, fine tremors, damage to kidney tubules and in cases of high, long-term exposure, chronic nephritis. Other effects include certain muscular weaknesses ("wrist drop") and lead encephalopathy.

The most commonly used indicator of lead exposure is the whole blood lead level. Toxic effects of lead may occur at levels so low that a threshold is effectively nonexistent. In other words, there may be no completely safe exposure to lead for children. Other signs of low-dose lead toxicity include learning deficits and growth retardation in children and hypertension in middle-aged men. Exposure to low doses of lead in childhood causes long-lasting effects that are thought to be irreversible. Sensitivity to the adverse effects of lead extends from fetal development to the cessation of growth after puberty. At very high exposure levels, lead may produce severe reproductive toxicity, inducing premature deliveries and spontaneous abortions in women and sterility in men.

Human Exposure to Arsenic in Soil and Tailings

Elevated levels of arsenic were also found in tailings at both mine sites. In order to evaluate the significance of these elevated levels, a PRG was developed for a hypothetical adult recreationist receptor using the following equation:

$$PRG = \frac{TR \times BW \times AT}{EF \times ED \left[\left(\frac{IRS \times BA \times CSF_o}{10^6\ mg/kg} \right) + \left(\frac{SA \times AF \times ABS \times CSF}{10^6\ mg/kg} \right) + \left(\frac{IRA \times CSF_i}{PEF} \right) \right]}$$

where:

TR	=	target cancer risk (1E-06)
BW	=	body weight (kilograms [kg])
AT	=	averaging time (days)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BA	=	bioavailability (unitless)
IRS	=	soil ingestion rate (mg/day)
CSF_o	=	cancer slope factor for arsenic (oral exposure route) ($(mg/kg/day)^{-1}$)
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PEF	=	particulate emission factor (m^3/kg)

Human exposure to arsenic occurs primarily through chronic oral ingestion of a variety of organic and inorganic forms of arsenic. Food constitutes the largest source of daily exposure to arsenic. Humans consume an average of 25 to 50 μg/day arsenic from this source. The particular form of arsenic ingested is a critical factor. Trivalent arsenic compounds are more toxic than pentavalent forms. However, the pentavalent form is most commonly found in the environment because natural oxidation processes in the environment favor it.

Water-soluble arsenic is efficiently absorbed from the gastrointestinal tract. Reaching the systemic circulation, trivalent arsenic is detoxified in the liver by conversion to methylarsenic acid and dimethylarsenic acid, which are the principal forms excreted in the urine. The body burden of arsenic can reach considerable levels since it can be sequestered in nails, hair, bones, teeth, skin, liver, kidneys, and lungs.

The adverse health effects produced by arsenic are highly dose dependent. For example, at low concentrations, arsenic may be an essential nutrient and substitute for phosphorus in key biochemical reactions. At high levels, however, arsenic has been recognized as an effective human poison. At toxic levels, it produces severe gastrointestinal irritation, including hemorrhage, and a form of peripheral arteriosclerosis known as blackfoot disease.

Exposure to low levels of arsenic can produce malaise and fatigue, gastrointestinal distress, anemia and basophilic stippling, and neuropathy. The most characteristic pathological effects of chronic arsenic poisoning, however, are skin lesions, particularly plantar and palmar hyperpigmentation and hyperkeratotic lesions. Although these lesions in themselves do not pose a significant health concern, they may ultimately develop into malignant skin cancers and metastasize to other parts of the body.

Health Risks Due to Contaminated Fish Consumption

In addition to the health risks posed by contaminated soil and tailings, fish collected at sites downstream of the Pacific Mine site in the American Fork River show elevated concentrations of lead, arsenic, and zinc. Fish were not analyzed for mercury. The Food and Drug Administration (FDA) has not established safe levels (action or guidance levels) for detected metals in fish per se, but has established them for lead and arsenic in crustaceans and shellfish. The guidance levels for arsenic are 76 in crustaceans and 86 ppm in shellfish. The corresponding guidance levels for lead are 1.5 in crustaceans and 1.7 ppm in shellfish. By comparison, maximum levels of lead and arsenic detected in locally caught fish, although significantly elevated downstream of the mine sites, are still less than 1 ppm.

ECOLOGICAL RISKS

In addition to the screening assessment of human health risks associated with lead and arsenic in tailings material at these sites, a preliminary evaluation of ecological impacts was conducted for arsenic, cadmium, copper, lead, mercury, and zinc. This screening evaluation was based on results of sampling of surface water, soil, and macroinvertebrates, and also included consideration of potential effects on soil invertebrates, soil microbes, terrestrial plants, and fish. No sediment samples were collected; therefore impacts related to potential sediment exposure could not be evaluated and may be underestimated.

candidate for endangered species listing. Note that the presence of the spotted frog at these mine sites has not been verified. No studies of possible effects on the abundance of the Bonneville cutthroat trout or other native fish species have been conducted.

That the above adverse effects on stream fauna are being caused by mine runoff contamination is supported by the fact that lead and zinc concentrations in runoff from these sites are significantly above EPA ambient water quality criteria (AWQC) for the protection of aquatic life. The EPA AWQC for arsenic, cadmium, copper, lead, mercury, and zinc are shown in Table 2. Table 2 shows the criteria maximum concentration (CMC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect" and the criterion continuous concentration (CCC), which is "an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect."

Concentrations of metals were below detection limits in most reaches of the American Fork proper, and average concentrations were below the corresponding AWQC. However, metals concentrations did exceed AWQC in tributaries to the American Fork and in surface runoff. For example, zinc levels considerably in excess of 120 µg/liter(L) (total zinc) (CCC/CMC) were detected at 5 of 20 locations sampled in tributaries of the American Fork River downstream of these mine sites. Lead and cadmium also exceed their corresponding CCC at 4 of 20 and 5 of 20 locations, respectively, in American Fork tributaries. Surface runoff concentrations of metals also significantly exceed corresponding AWQC at many locations. Zinc concentrations found in Pacific Mine runoff range up to 2,520 micrograms per liter (µg/L) (total zinc) while lead and cadmium concentrations range up to 130 µg/L lead and 27.1 µg/L cadmium respectively (as total metal).

CONCLUSIONS

Metals-contaminated soil and mine waste (tailings) present imminent health risks to the public and the environment at the Dutchman Flats and Pacific Mine sites. In particular, inhalation, dermal, and ingestion exposure of recreationists accessing these areas is expected to result in unsafe exposure to lead and arsenic. PRGs were developed for arsenic and lead using standard EPA methods. Comparison of these PRGs to levels of lead and arsenic detected in site soils and tailings materials indicates that many areas of these sites must be considered unsafe for recreational use. Levels of lead, arsenic, and zinc are elevated in fish collected downstream of these sites. However, these levels are still less than available safe levels (guidance levels) established by FDA for metals in seafood. Metals-contaminated mine runoff is adversely affecting stream fauna as indicated by 1) reduced macroinvertebrate populations downstream of these sites, and 2) by significant exceedances of AWQC for zinc, lead, and cadmium in mine runoff, the American Fork River, and tributaries of the American Fork River. The lack of sediment data and data regarding concentrations of contaminants in forage is likely to result in an underestimate of wildlife exposure to site contaminants.

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Table 2

Toxicological Benchmarks for Metals at Dutchman Flats

Metal	Terrestrial Plants[1] (mg/kg soil dw)[2]	Soil Invertebrates[3] (earthworm) (mg/kg soil dw)	Soil Microbes[4] (mg/kg soil dw)	AWQC[5] CMC[6] (ug/L)	AWQC[5] CCC[7] (ug/L)
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Cadmium	3 to 100	20	20	4.3	2.2
Copper	60 to 125	50	100	13	9
Lead	50 to 1,000	500	900	65	25
Mercury	5 to 35	0.1	30	1.4	0.77
Zinc	50 to 500	200	100	120	120

[1]From ISSI (1999).
[2]soil dw = soil dry weight basis
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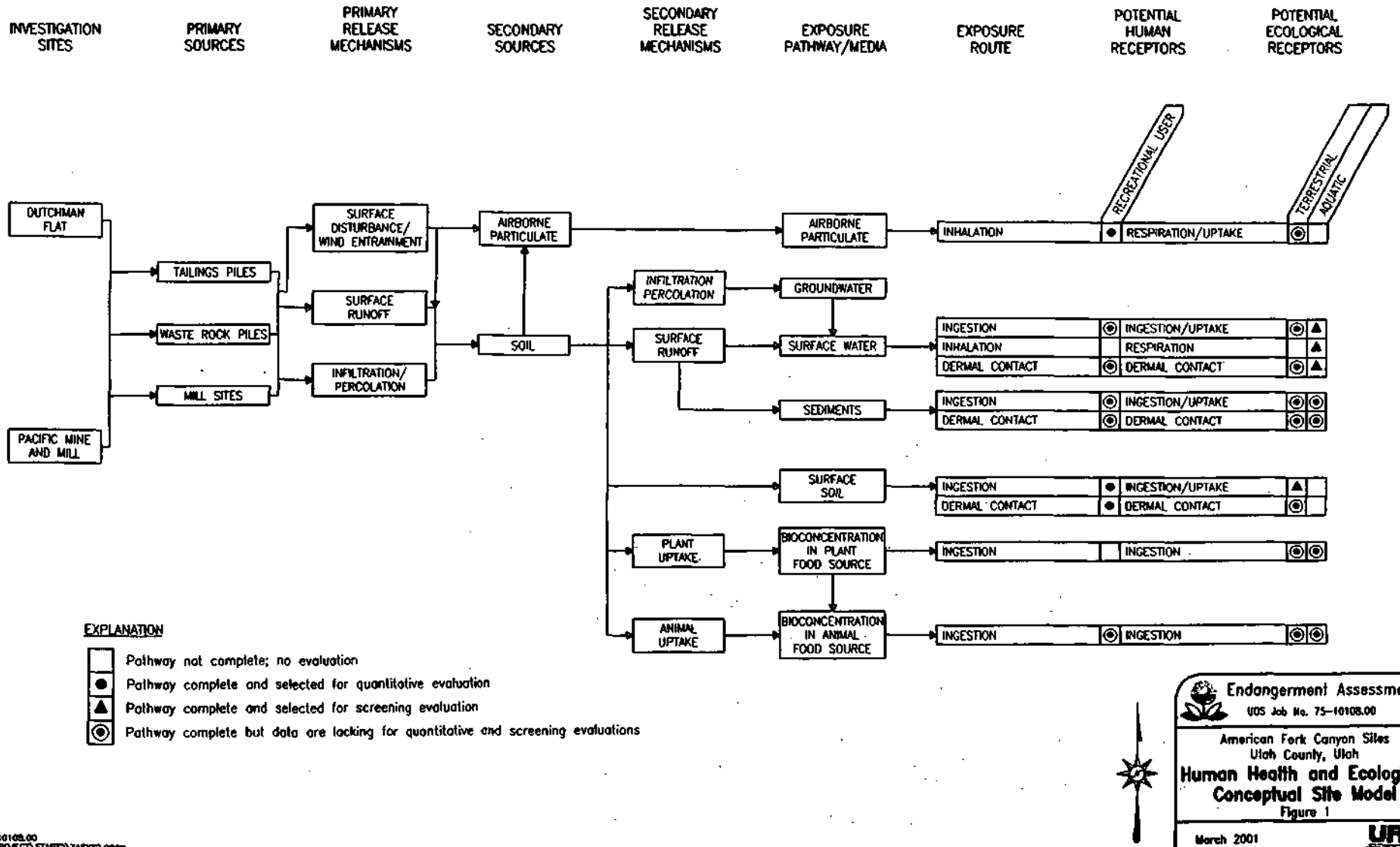
ug/L = micrograms per liter
mg/kg = milligrams per kilogram

URS Operating Services
START2, EPA Region VIII
Contract No. 68-W-00-118

American Fork Canyon Sites
Revision: 0
Date: 03/2001



Endangerment Assessment

UOS Job No. 75-10108.00

American Fork Canyon Sites
Utah County, Utah

Human Health and Ecological Conceptual Site Model

Figure 1

March 2001

URS

75-10108.00
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